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WATER MITES (ACARI: HYDRACHNIDIA) FROM PENINSULAR MALAYSIA: DESCRIPTIONS OF NEW SPECIES.

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(Accepted November 2004)

SUMMARY: Water mite collections from the Malay Peninsula made by Dr J. I. Futardo in 1973 and by the authors were examined and four new species: Oxus multiscutata, Forelia futardoi, Arrenurus trigonus and Arrenurus malayensis and one new subspecies Neumania (Ecopolopsis) multiscutata testudinata are described.

INTRODUCTION

During the past two decades a number of restricted collections have been made by the author from the Malay Peninsula and S. E. Asia (WILES, 1988, 1990; 1993, 1997b, 1999). These partially establish the typically tropical Asian water mite fauna against which the fauna of islands across Wallacea are compared. In the early 1970’s J. I. Futardo was actively describing the invertebrate fauna of Malaysia but he never identified and seldom collected the water mites. When he retired the remaining mite materials consisting of 20 bottles of mites, preserved in alcohol or formalin and later transferred to Koenikes’ solution were passed on to P. R. Wiles for examination. Most bottles contained less than 5 mites. Seventy four slide preparations of squashed specimens of poor quality completed the collection. Most slide preparations could only be identified to genus and there many were duplicate specimens. Much of the preserved material had deteriorated, was difficult to process, and therefore of little taxonomic value. The locations on labels were also generally imprecise and did not locate specific sample sites or habitat types e.g. small fish pond, S. Midahi Cheras, 26.9.1973 (assumed to be in Selangor state as other collections on previous and subsequent days are from Selangor). Slide preparations mounted in glycerin jelly or Hoyer’s were made of 22 preserved specimens.

This paper describes new species found amongst old collections. Collation of this information with published records indicates that there are at least 23 genera on the Malay Peninsula compared to 75 reported for S. E. Asia (TABLE 1).

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Mites were collected using dip nets (0.3mm mesh), sieved through Endecott sieves (30cms diameter (3.0mm and 0.3mm mesh), transferred to a white tray and live mites picked out before preservation in Koenike's solution (glacial acetic acid : alcohol : water 1 : 5 : 4). In the laboratory mites were cleared in Lundblad's solution for 7 days up to 150 days to remove lipids, washed in Koenike's solution, and then dissected and displayed in double coverslip mounts. Mites were dissected at the edge of a 22mm diameter coverslip in glycerin jelly and parts orientated to the middle of the coverslip. When the jelly had set, the round coverglass was inverted onto a square 22mm coverslip of fresh glycerin jelly. When the jelly had set the double coverslip was placed on an aluminium mount over a 21mm hole, sealed with glycel and given a unique slide number (e.g. M425).

The nomenclature for the descriptions follows Wiles (1997a, 1997b). Measurements are given in µm. Synonymy prior to 1987 may be found in Viets, K. O. (1987). New records are indicated by an asterisk. Abbreviations are: A = antennal glandularia, D = dorsioglandularia, E = epimeroglandularia, g = slit organ (= lyrifissure sensu Wiles 1997b), L =
lateroglandularia, R = ocularia, V = ventroglandularia, Ep = epimeron (= coxa sensu Cook, 1974), Gp = genital plate, Ib = infracapitular bay, Ib — Gp = distance between back of infracapitular bay and front of genital plates, MS = median suture from the point of fusion of epimeral sutures between first and second epimera medially to the front of the genital plates, P = pedipalp, I-Leg-6 = first leg, sixth segment (tarsus), I-IV-Leg-3-6 = first to fourth leg, segments 3 to 6 (patella to tarsus sensu Harvey (1996)).

Holotype slide preparations will be deposited in the Natural History Museum, London; other preparations may be held by the author prior to deposition.

TAXONOMY

Superfamily Lebertioidea Thor 1900
Family Oxidae Viets 1926

Frontipoda multiscutata new species

(FIG. 1)


Description. Female: body length 730, height 615, width 550. Ventral shield patterned and hirsute, extending up sides of body and over dorsum; L2 located dorsal to IV-Leg socket. Numerous dorsal platelets, glandularia A1, A2, R1, R2, D1-4, L1, L3, L4, V4 and slit organs g1-g5 free in integument or lightly fused to ventral shield. R2 on separate platelets; E4 apical on Epl, E2 posterior to III-Leg socket and V3 located at posterior end of ventral shield; genital field enclosed by ventral shield, I1-Gp 222, three pairs of acetabula, length of genital plate 136, width of genital field 129; anal pore, V1 and V2 located on broad platelet that is almost completely fused to the ventral shield behind the genital field. Pedipalp typical (PIII damaged in dissection), length PI, PII, PIV, PV 56, 54, - 88, 20. IV-Leg lacking claws and terminating in a short seta. Swimming setae on II-IV-Leg-5 are 13, 16 and 15 respectively. Length I-Leg-3-6 75, 105, 134, 119; II-Leg-3-6 83, 133, 179, 159; III-Leg-3-6 103, 153, 193, 193; IV-Leg-3-6 123, 149, 199, 216.

Etymology. multiscutata refers to the numerous dorsal platelets in the dorsal furrow.

Discussion. This species is most similar to Frontipoda spinipes Viets K.O. 1976 from Australia in shape, epimeral surface sculpturing, and leg and pedipalp morphology. However, F. multiscutata n. sp. has many platelets behind R2, the horizontal suture line seen from the dorsal and lateral views is poorly defined and the anal pore is further from the genital field.

Superfamily Hygrobatoidea Koch 1842
Family Pionidae Thor 1900

Forelia futardoi, new species

(FIG. 2)


Description. Male: A2, R2, D1-4, L2 and L4 located on large dorsal plate that covers the entire dorsum, length 600, width 438. A1, R1, L1, L3 and V4, two or three platelets and slit organs g1-g5 free in membrane between dorsal plate and ventral shield, (anterior platelet is fused with dorsal plate in specimen M631). Ventral shield projecting anteriorly beyond epimera, length 598, width 485. EpIII posterior suture line bisecting ventral shield immediately anterior to genital field; EplV posterior suture line 'W'-shaped line, IB-Gp 159, Bb-anal pore 319. Genital field with many acetabula distributed along the posterior margin of EplV. E4 located posteroventral to genital pore, V3 fused to the lateral edge of ventral shield above acetabula, V1 and V2 located posterolateral to anal pore. Pedipalps with gentle ventral bulge to PII and with a marked extension to the dorsodistal margin of PIV, length PI-PV 31, 125, 42, 125, 50. Swimming setae on II-Leg-5 3, III-Leg-4 3, III-Leg-5 6, IV-Leg-5 6 + 2. Length I-Leg-3-6 80, 73, 116, 149, II-Leg-3-6 86, 116, 136, 136, III-Leg-3-6 100, 126, 153, 186, IV-Leg-3-6 86, 83, 110, 76.

Etymology. Species named after J.I. Futardo for his contribution to water mite research.

Discussion. We have placed this species in the genus Forelia Haller 1882 rather than the similar genus Pseudofeltria Soar 1904 as the tarsus and tarsal claws of the third leg (III-Leg-6) in males differ to the
FIG. 1: *Frontipoda multisculata* n. sp., a. — dorsum, b. — venter, c. — posterior view, d. — lateral view, e. — pedipalp, f. — I-Leg, g IV-Leg. Scale line abcd 65 μm, e = 40 μm, fg = 133 μm.
Fig. 2: *Forelia futardoii* n. sp. male, a. — dorsum, b. — venter, c. — IV-Leg, d. — I-Leg-6, e. — III-Leg, f. — II-Leg-6, g = pedipalp. Scale line a = 133 \( \mu \text{m} \), b = 90 \( \mu \text{m} \), cdef = 65 \( \mu \text{m} \), g = 40 \( \mu \text{m} \).
first two pairs of legs (Smith, Cook and Smith 2001). III-Leg-6 is longer, more slender and dips ventrally towards the distal end compared to I-Leg-6 and II-Leg-6. *Forelia futardoi* n. sp. is most similar in form to *F. tuberculata* Lundblad 1969 from Burma but differs in that PV slopes from the dorsal distal spine straight back to the median ventral setae, PII has a much reduced ventral swelling to ventral PII and there are fewer and stockier short distal spines dorsally on IV-Leg-6. The female described by Lundblad as *F. tuberculata* because it came from the same location as the male has a very different pedipalp lacking a ventral projection. It is not certain whether this is the result of sexual dimorphism, variation in pedipalp structure or a misidentification of the female. Even if the pedipalp is variable in structure it is unlikely the form taken will fall into the variability range of *Forelia futardoi*.

Superfamily Hygrobatoidae Koch 1842  
Family Unionicolidae Oudemans 1909  
*Neumania (Ecopolopsis) multiscutata testudinata*,  
new subspecies  
(Fig. 3)


Etymology. The name "*testudinata*" refers to the heavily sclerotised idiosoma.

Discussion. There are several subspecies of *Neumania multiscutata* (Piersig 1906) characterised by the pattern of fusion between dorsal platelets (Cook, 1967). The subspecies and reported sexes are: *Neumania multiscutata multiscutata* (Piersig 1906) male from Bangkok, Thailand; *N. m. walteri* (Walter 1923) male & female from Canton, China (Cook, 1967; Cook, 1974); *N. m. japonica* (Uchida and Imamura 1953) female from Japan (Cook, 1967); *N. m. pulcherrima* Viets 1935 from Sumatra, Indonesia (Cook, 1967); *N. m. bharatensis* Cook 1967 female from southern India and *N. m. sepikensis* Wiles 1997c male & female from Papua New Guinea. Plate fusion is least in Japanese and Papua New Guinean specimens. Most descriptions are based on single males or females but in *N. m. sepikensis* Wiles 1997c two males show a greater degree of plate fusion than the single female.

The female of *Neumania (Ecopolopsis) multiscutata testudinata* new subspecies, from the Malay Peninsula, differs from the other subspecies in that all platelets are incorporated into a heavily sclerotised and porose dorsal shield that is fused to the ventral shield. The pattern of platelets is clearly visible in the dorsal shield. The only small gaps between shields are visible anterior to the pregenital sclerite and between

![Fig. 3. *Neumania (Ecopolopsis) multiscutata testudinata*, n. subsp., female. a. — venter, b. — dorsum, inset - cuticle across anterior platelet and glandularium showing pores in thick integument. Scale line ab = 170 μm, c = 65 μm](image-url)
posterior epimera. This is by far the most heavily sclerotised specimen recorded and is thus given subspecific rank.

Superfamily Arrenuroidea Thor 1900
Family Arrenuridae Thor 1900
*Arrenurus (Arrenurus) malayensis* new species
(Figs. 4-5)

Material examined. Holotype male slide M646, 10 September 1973, Marsh at Jerangan, Trengganu, Malaysia. Other material: M649 female from same site Collected: J. I. Futardo.

Description. Male: body square in shape, length excluding petiole 543, width 553. Dorsum with no humps; dorsal furrow incomplete, terminating on indistinct pygial lobes, D4 setae short and associated with large glands; V3 setae thickened, located above posterior margin of idiosoma and ventrolateral to D4 gland. Posterior margin of idiosoma straight. Ventral shield with distinct epimeral sutures, medial margin of EpiIII shorter than EpiIV, EpIV concave around E4, gonopore and anal pore in vertical plane below petiole. V2 setae extending well beyond petiole. Petiole short, tubular with complex internal membranes. Posterior margin of idiosoma flat with L4 not on prominent humps. Pedipalp typical with pointed distoventral projection to PIV; length PII-PV 59, 49, 80, 32. Swimming setae on II-Leg-5 1, II-Leg-4 3, III-Leg-4 5, III-Leg-5 5, IV-Leg-3 8 IV-Leg-5 4 + 11. Length I-Leg-3-6 75, 96, 105, 154, II-Leg-3-6 85, 98, 121, 177, III-Leg-3 89, 119, 125, 136, IV-Leg-3-6 125, 136, 88, 88.

Female. Body blue green, rounded with no humps, length 460, width 460. Dorsal furrow incomplete. Ventral shield with distinct epimeral sutures, medial margin of EpiIII longer than EpiIV. Posterior margin of EpIV straight in front of E4, acetabula field tapering from gonopore to lateral margins of idiosoma. Pedipalp typical and PIV less pointed at the ventrodistal margin than the male; length PII-PV 33, 63, 52, 75, 38. Swimming setae on II-Leg-3 3, II-Leg-4 2, III-Leg-4 2, III-Leg-5 6, IV-Leg-3 2, IV-Leg-4 5 IV-Leg-5 5. Length I-Leg-3-6 65, 80, 87, 105, II-Leg-3-6 71, 84, 86, 94, III-Leg-3 40, 79, 92, 84, IV-Leg-3-6 92, 87, 87, 90.

Etymology. The name "malayensis" refers to the country of origin of the species.

Discussion. In males the short cylindrical petiole with complex internal membranes is autapomorphic. Males are also short, rounded with a flat posterior end to the body lacking prominent humps to L4 (see Fig. 4b) and other glandularia. The shape and petiole structure make this quite different to other *Arrenurus* species with petioles. They are either more elongated in shape, have well developed posterior humps to L4 and other glandularia and have different petiole structures. Similar species include *A. mysorensis* Cook 1967 and *A. rouxi* Walter 1929. Both have more prominent lobes to L4 and petioles of different structure. *A. rouxi* has a more elongate body shape.

The female found with the male may not be of the same species as it is smaller and lacks the clearly pointed dorsodistal margin to PII. However, the colour and appearance of the animal is similar to the male. Confirmation of the female requires further material and descriptions of females of other species for comparison.

Superfamily Arrenuroidea Thor 1900
Family Arrenuridae Thor 1900
*Arrenurus (Arrenurus) trigonus* new species
(Fig. 6)


Description. Male: body triangular in shape, length 425, width 398. Dorsum with no humps; dorsal furrow incomplete, terminating on small pygial lobes, D4 setae short and stout and associated with large glands. Posterior margin of idiosoma between short, stout, blunt V3 setae and pygial lobes is straight. Ventral shield with indistinct suture between anterior epimera, medial margin of EpIII shorter than EpiIV, EpIV strongly concave around E4, gonopore located ventral to the anal pore and petiole. Petiole short, gutter-shaped with a vertical medial ridge tapering posteriorly. No setae project far beyond the petiole. Pedipalp typical of genus and short; length PII-PV 53, 46, 81, 35. Swimming setae on II-Leg-5 2 small, II-Leg-4 2 small, III-Leg-4 3,
Fig. 4. Arrenurus (Arrenurus) malayensis n. sp., male; a. — dorsum, b. — lateral view, c. — posterior view, d. — venter, e. — IV-Leg, f. — pedipalp. Scale line abcd = 135 μm, e = 65 μm, f = 33 μm.
**FIG. 5.** *Arrenurus* (*Arrenurus*) *malayensis* n. sp., female; a. — venter, b. — lateral view, c. — pedipalp, d. — IV-Leg. Scale line ab = 90 μm, c = 40 μm, d = 65 μm
Fig. 6. *Arrenurus* (*Arrenurus*) *trigonus* n. sp., male. a. — venter, b. — dorsum, c. — IV-Leg, d — pedipalp. Scale line ab = 90 μm, c = 65 μm, d = 40 μm.

III-Leg-54, IV-Leg-45 IV-Leg-57 + 4. Length I-Leg-3-6 63, 79, 79, 113, II-Leg-3-6 75, 92, 90, 125, III-Leg-3-6 100, 81, 113, 131, IV-Leg-3-6 109, 144, 56, 56.

Etymology. The name “*trigonus*” refers to the triangular shape of the idiosoma.

Discussion. The short gutter-shaped petiole with a vertical medial ridge tapering posteriorly and the triangular body shape are diagnostic.

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